AN ANALYSIS OF THE PATENTS AND THE PROTECTION OF DIGITAL INNOVATIONS IN E-COMMERCE PLATFORMS

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ABSTRACT

This article casts doubt on the efficacy of existing patent systems in safeguarding digital works on e-commerce websites alongside proposed modifications that align with the demands of the digital economy.The research takes a doctrinal method of research to examine laws, court decisions and scholarly literature and concepts elsewhere as far as India, China, the United States, European Union. It is possible to focus on the analysis of the question through this approach of whether the current regulations are sufficient to protect platform based technologies such as algorithms, artificial intelligence based systems, encryption modeling, and digital payment systems. E-commerce platforms are currently the major contributors to global trade and innovation, although their digital innovations are extremely fragile, owing to their etherealness, mathematicalness, and easy imitability. The controversy falls within the width of the greater controversy between pre-existing notions of patentability, and those introduced by software and algorithm-based inventions, which often blur the boundary between technical applications and abstract ideas. Numerous legal interpretations of the judicial system show not only the diversity of approaches of countries but also the jurisprudential vagueness of inventors. It has been found that patent continues to be an indispensable stimulant to invention, licensing, and competition, yet the contemporary structures are obstructed by statutory ambiguity, judicial inability to provide rigid interpretation, and executive malpractice. cross-border enforceability, duplicate intellectual property systems, and threat of monopolization. Some of the proposed modifications involve the enhancement of the legal meaning of technical effect, the creation of special patent benches or online IPR cells, and the deployment of artificial intelligence and blockchain tools to monitor and punish.

Keywords: Digital technologies, e-commerce, protection of patents, software and algorithms, international enforcement, intellectual property, international harmonization, artificial intelligence, blockchain.

1. Introduction

"Law must be stable, yet it cannot stand still." — Roscoe Pound.

This is what explains our present issue with patent law. Due to the rise of commerce, blockchain, artificial intelligence and digital payments, cross border trade has become easy and faster[1]. The internet sites have ceased being middlemen but they have become important as a global source of trade, innovations and economic development. Based on this, it is even more necessary to protect digital innovations by businesses, governments, and consumers.

This research is aimed at critically discussing the adequacy of the existing patent regimes in protecting digital innovations made within the e-commerce platforms and advising on changes that will enhance better protection under the digital economy. Although patents are applied to protect physical innovations, algorithms, AI systems, encryption systems, and other payment technologies represent a challenge since they are intangible, platform-dependent, and cross-border due to the outrageous effect. These are the problems most of the time beyond the focus of the legal systems in place that are defined by gaps in jurisdiction, vague laws and lack of enforcement policies. The aforementioned issues ought to be aggravated by the fact that certain questions such as the vagueness of legal codes, issues with the patent system in different countries, and the clandestine nature of internet piracy or duplication pose a challenge in setting up an argument. Threats that inventors have to deal with entail unfair competition and duplication that stifles new research and development, kills consumer confidence and confidence, as well as reduces the capacity of nations to compete internationally[2].

The main problem is that existing regimes of patent protection do not exist to protect the digital innovations in the field of e-commerce. The digital innovations are incomparable to the traditional inventions because they are immaterial, algorithm-based, and notable to a platform, hence challenging to define, identify, and protect using outdated patent laws. There are massive loopholes in the enforcement by the existence of ancient legal rules, across-jurisdictions uncertainty, and invisibility of online duplication and piracy[3]. This low protection exposes

[1] World Intellectual Property Organization, World Intellectual Property Report 2019: The Geography of Innovation in the Digital Age (2019)
[2] World Intellectual Property Organization, World Intellectual Property Report 2022: The Direction of Innovation(2022)
[3] Organisation for Economic Co-operation and Development (OECD), OECD Digital Economy Outlook 2024: Embracing the Technology Frontier (Vol. 1, OECD Publishing 2024)

inventors to threats on imitation and unfair competition, impacts negatively on research and development, and decreases consumer confidence, as well as harms the competitiveness of enterprises and nations in the digital economy[4]. Proper patent protection is also very essential to ensure that unfair competition, piracy and fake products do not affect the competitiveness, consumer trust and investment of platform based industries. Consequently, absence of adequate legal protection may curtail innovations and reduce the competitiveness of a country or corporation in the present day society.

Although patents have been researched over a long period in the conventional sector, a gap in knowledge regarding how they can be beneficial to digital platforms still remains evident in e-commerce. Most of the available literature discusses the property within intellectual property without consulting the digital matters or focusing on legal frameworks of a particular country and not putting into consideration international trade. Digital trade is too complex to deal with conventional strategies, which have been observed in real-world situations, such as the copying of an algorithm, unprofessional procedures, and lack of control on the border. This brings up major questions: First, do our laws in the present day remain abreast of the high rate of digital change and the global scope of e-commerce? Second, what is the legal and technological change that can enhance patent enforcement in the digital world and thirdly, how are the various international patent regimes harmonized to create a balance between innovation and healthy competition.

In response to this, this research paper investigates the effectiveness of the existing patent legislation in safeguarding digital innovations applied in the e-commerce industry. It has three key objectives: one, to determine whether the current laws are sufficient to ensure protection of the processes and algorithms, as well as to investigate new technology-driven approaches to law-enforcement that would enhance online protection of patents, and lastly, propose options as to making patent laws more consistent across nations.The prime objective is to demonstrate how patent systems may be refurbished to offer greater facilitation to innovation, make certain there is fair competition, build consumer confidence, and facilitate the e-commerce development in a sustainable manner in the future.

2. Review of Literature

[4] Xin Ouyang, Zhen Sun, Xinzhen Xu, Patent System in the Digital Era: Opportunities and Challenges, (2022)

Kevin J. Boudreau, Milan Miric & Lars Bo Jeppesen (2022)[5]

The authors offer a valid point that the position of patents on the electronic inventions within a web based commerce site is multifaceted and dynamic. The authors attempted to test the empirical effectiveness of patents and copyright in safeguarding digital commodities, typically mobile apps, in their doctrinal analysis of information retrieved on the Apple App Store, through analyzing the product-level data. Based on the research, they concentrated on the influence of product-level differentiation on IP strategy and efficacy by assisting in determining whether innovations that are based on original design or distinct contents characterize it. The proliferation of digital goods in e-business where efficient copying is difficult to defend by traditional privacy laws, heightens the necessity of this research, design, and strenuous international enforcement. The paper addresses the current issues of how platform-driven economies could assist digital firms and corporations to acquire a value and maintain a competitive advantage. Most importantly, a doctrinal gap exists in the existing literature since, although studies in the past tended to pay attention to industry or rather firm determinants, this study highlights the underutilised role of product features in deciding whether or not patent protection is appropriate and efficient in digital settings. Future research could examine platform-related governance, issues of the geographical enforcement, and emergence of non-conventional intellectual property strategies to develop doctrines, therefore providing more nuanced approaches to managing innovation and legal safeguarding of e-commerce settings.

Ya Wang & Yanmei Yang(2022)[6]

The focus of the paper titled Intelllectual Property Protection in E-commerce is largely based on the problem of protecting patents and digital inventions in the rapidly expanding e-commerce China setup.Goal: The aim of the study is to evaluate the effectiveness of the Chinese Electronic Commerce Law, particularly practices of patent protection and to offer suggestions of the legal streamline. and efficient structures governing intellectual property rights on electronic channels. To highlight the frequency of the poorly addressed and technically challenging patent infringement as compared to copyright and trademark issues, the Authors highlight the need to explain the relationship between law rules and the reality of e-commerce networks functioning. The relevance of the study lies in the fact that the key to the

[5] Kevin J. Boudreau, Milan Miric & Lars Bo Jeppesen, Profiting from Digital Innovation: Patents, Copyright and Performance, 51 Res. Pol'y 104477 (2022)
[6] Ya Wang & Yanmei Yang, Intellectual Property Protection in E-Commerce, 8 Int'l Core J. Eng'g 152 (2022)

economic growth of the country centers its power and the increased role of patents and digital innovations as a stimulus of technical progress in the e-commerce sphere that has the innovation. Substantial legal protection is essential towards encouraging investor interests in innovation and impacting the existence of a level playing field to support platform sustainability. The discussion on the insufficiency of the notification deletion rule in protecting patents sheds light on the necessity in specific rules which would necessitate mutual consultation with professional associations that would cover the highly technical and obscure nature of patent infringement on the Internet. Among the significant research gaps pointed out by the article, there are the absence of clear and technologically specific tools within patent-related conflicts in electronic commerce and it is upon the subsequent research to employ. The overuse of general platforms put them in a poor position in preventing or remediating patent violations due to the regulations, poor supervision of professionals, and the absence of specific guidelines on what constitutes effective notice and what constitutes necessary measures. Future studies should focus on the use of improved statutory definition and implementation of technology-oriented methods in deterring and reducing the levels of patent infringement in e-commerce.

Geraldine O. Mbah(2024)[7]

The article US Intellectual Property Law and Its Effect on Business: Recent Developments and Trends is much closer in defining the shift of the role of intellectual property (IP) law in securing creativity particularly in the digital economy. The aim of the study is to assess judicial precedents and legislative modifications to the U.S. intellectual property law, namely the America Invents Act, the Digital Millennium Assess the ramifications of Copyright Act, and the Defend Trade Secrets Act on the growth of business, competition, and innovation. Although it addresses a wide array of sectors, one such being biotechnology, artificial intelligence and e-commerce, the paper focuses on provisional licenses and digital rights as some of the important means of protecting online inventions. The topicality of the study lies in its focus on how the rights of copyright enable the companies to compete in a technologically focused economy. Although trademarks and copyrights deal with brand protection and digital pirating, patents deal with technical means and algorithms of e-commerce systems. This is particularly important in light of the rising cases of counterfeiting, domain squatting, and the use of illegal

[7] Geraldine O. Mbah, U.S. Intellectual Property Law and Its Impact on Business: Recent Developments and Trends, 13 Int'l J. Sci. & Res. Archive 3279 (2024)

content on the international digital platforms.Strong IP enforcement is not only an incentive to innovation, but also enhances consumer confidence and market fairness, and as such a substantial platform towards sustainability in digital business.Nevertheless, the evident gap in research emerges. Even though the article provides a macro-level analysis of the U.S. IP law, it fails to explore deeply into the convergence of patents and digital innovations in e-commerce. Platforms. Little-researched issues are patenting algorithms, protecting platform-specific technologies, and balancing the privacy between transparency and exclusivity in the digital market.Through its focus on patents as the tool of protecting technical progress in e-commerce and analyzing its success and proposing modifications, your research could seal the gaps in platform-related enforcement and global peace.

Nilendu Chatterjee(2024) [8]

According tothe author, the role that intellectual property rights (IPR) and patents in particular, can play towards protecting the innovation and on the growth of e-commerce sectors is significant behind the title of her article, Intellectual Property Rights and Development of E-Commerce Sectors. The purpose of the study is to provide a comprehensive understanding of the history and evolution of IPR, its use in e-commerce and role of a variety of the kinds of intellectual property such as patents, trademarks and copyright among others, in protecting digital breakthroughs. It particularly looks into the role of patents in tech process, coding, algorithm, and online system protection to encourage technology. The work is topical because electronic shopping platforms are heavily reliant on online technologies, programs, and services that are prone to piracy, forgery, and unlawful reproduction. The paper puts an upward stress on the necessity to assure long-term growth of digital commerce through the use of strong IP. structures by emphasizing the importance of patenting as a tool of protecting digital assets, guarding business interests, and obtaining licensing opportunities. This particularly matters in the modern global markets which are technology driven and when business strategies are based on digital advancements. The study however indicates a gap in research. Although it introduces a general discussion of the relevance of IPRs in e-commerce, the paper fails to comprehensively examine the finer challenges of patenting digital innovations, such as algorithms, artificial intelligence devices and technology-specific to a platform. This research can address this gap by focusing on the way patents can be more also tailored to protect online innovations in e-

[8] Nilendu Chatterjee, Intellectual Property Rights and Development of E-Commerce Sectors, (2024)

commerce and thus create exclusivity against innovation and how global compatibility may be achieved in the application of patent protection concerning digital platform.

Xin Ouyang, Zhen Sun, Xinzhen Xu(2022)[9]

The paper also provides an in-depth analysis of how the patent system is evolving to respond to the digital revolution. The study aims at looking at the adaptation of patent law to digital technologies and the issues that it faces in protection of inventions such as Software, algorithms, data-driven instruments and platform-based business models. This paper notes that although patents continue to play the core of intellectual property, digital complexities are straining its effectiveness. Concepts that frequently blurred pertinent boundaries of patentability. The relevance of the research is because it explores the role of patents in facilitating creativity and competitiveness in technology-based industries such as e-commerce. In the case of e-commerce, patents help a business to thrive sustainably through deterring infringement and encouraging investment along with safeguarding technical breakthroughs such as algorithms, payment systems, and cybersecurity systems. The article states that it is highly essential at this era of globalization to preserve the digital inventions through patent to facilitate trust, justice as well as longevity of digital trade. But something is known at the conversation. The article, though providing a general overview of patents in the digital economy, fails to address in particular the issue of patenting of inventions within e-commerce platforms. Some unexplored areas are patents on algorithms that can be utilized to determine what consumers see, safeguard overseas digital technologies, and creating a balance between consumer access and patent exclusivity. This study can help to close this gap by considering how patents protect platform-specific digital inventions in e-commerce and proposing modifications that would work to more effectively do so in greater detail. globally harmonized patent systems.

3. Research Methodology

To methodologically evaluate whether patent regimes are adequate, this paper will take a doctrinal approach, considering statutes, judicial precedents and commentary of scholarly literature. Competitive lenses are used to point out differences in national practices and set up avenues toward harmonization. This study will also add value by enhancing clarity in theories,

[9] Xin Ouyang, Zhen Sun, Xinzhen Xu, Patent System in the Digital Era: Opportunities and Challenges, (2022)

policy formulation, and the reinforcement of patent protection on digital commerce through the integration of legal theory.

4. Ideational Structure of Patents and Digital Innovations.

4.1 Meaning and Scope of Patents

A patent refers to intellectual property in which a person is given exclusive right to commercialize his or her invention within a fixed term, usually 20 years[10], in case his invention is made public. New inventions are those that involve an innovation step and have the potential of being used in industry, hence they are patented. Products, procedures, and methods that solve engineering problems are considered patents.Nevertheless, in the digital economy, the area of patentability has become increasingly complicated when it comes to new ideas that include software, algorithms and business practices.

In e-commerce, patents are not limited to physical items but are also related to authentication techniques, encryption, recommendation systems, digital payments-extending scope In very competitive internet markets, a need arises to protect digital assets once they have been created against duplication and illegitimate use. but it also complicates the possibility of interfering rights. and problems with the standard test of industrial application.

4.2. Development of Patent Protection in the Digital Age.

The industrial age first introduced the patent law as a protection over chemical and mechanical inventions.With the onset of the information age, patent systems needed to address the issue of protecting abstract, software-based inventions. In the United States, such a significant judgment as Diamond v. Diehr (1981)[11] made amends by patenting inventions that involved software provided that they had a technical application.Europe, by contrast, has been stricter and not granted protection to programs as such under Article 52 of the European Patent Convention (EPC)[12], but a software whose results are technical in nature.

Moreover, the e-commerce has experienced an outburst in e-commerce patent applications. The business method patents developed particularly in the United States following the case of State

[10] The Patents Act, No. 39 of 1970, § 3(k), India Code (1970).
[11] Diamond v. Diehr, 450 U.S. 175 (1981).
[12] European Patent Convention art. 52, Oct. 5, 1973, 1065 U.N.T.S. 199.

Street Bank v. Signature Financial Group (1998)[13]. The court affirmed that a computerised financial system could be patented in that case.This led to a boom in online recommendation algorithms, internet cart systems and models of online auction. However, subsequent cases such as Alice Corp. v. CLS Bank International (2014)[14] limited this ruling by declaring that abstract concepts implemented on a computer could not be patented considered they did not extend beyond the basic computer functionality with a creative concept.

Section 3(k) of the Patents Act in India specifically excludes mathematical or business method or even a computer program per se as a patentable type of invention, but judicial case law, and even guidance by the Patent office have increasingly permitted patenting of inventions involving computer programs, provided that a new technical effect is involved.

4.3 Distinction Between Traditional Patents and Digital Patents

Conventional patents also contrast fundamentally with the digital ones in terms of the subject matter and enforcement. Traditional patents cover physical inventions e.g. medications, chemicals and machinery.Instead, the digital patents apply abstract inventions such as encryption techniques, online transactions and algorithms. In addition to this, enforcement is quite different. Although it is feasible to monitors physical market to detect the use of traditional patents, online patent theft tends to go unreported as the activities in digital form of monitoring occur at the server-side or redirects in the software code that cannot be detected by the customer. This complicates the process of monitoring and requires advanced technology devices to detect this. Besides, as opposed to digital inventions that often cross borders in the shortest time possible, traditional patents often work within a particular national scope. An example is a company in china may replicate an algorithm that is patented in the United States and distribute it globally, therefore, posing a legal challenge in implementation.

4.4 Case Studies of Digital Innovations that are patented.

4.4.1. Amazon's One-Click Patent (US Patent No. 5,960,411)[15]: The Patent was approved in 1999 and included the process through which a consumer could make a purchase through the

[13] State Street Bank & Tr. Co. v. Signature Fin. Grp., Inc., 149 F.3d 1368 (Fed. Cir. 1998).
[14] Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 573 U.S. 208 (2014).
[15] U.S. Patent No. 5,960,411 (filed Sept. 12, 1997) (issued Sept. 28, 1999).

internet through the use of a single- click system. It was controversial, but it brought out the patentability of practices of e-commerce companies.

4.4.2. The Online Payment System Patents of PayPal[16]: PayPal controls several patents about secure online payment systems, such as fraud prevention methods and security authentication techniques. These patents have ensured that PayPal leads in the digital payment arena in substantial measure.

4.4.3 PageRank Algorithm by Google[17]: The supplementing components of the Google search algorithm, which proved critical to Google's business model, were patented. In case of the abstract algorithms though they cannot be patented, they can be safeguarded by integrating them into technical applications.

4.4.4 AI Tools and Recommendation Engines: The aspects of the recommendation algorithms of Netflix and Amazon have been patented owing to their significance in shaping customer behavior and generating revenue.

5. Current Legal Framework for Patent Protection in E-commerce

5.1 International Instruments

On the global front, patent protection is regulated by a number of treaties and conventions.

5.1.1. TRIPS Agreement (1995)[18]: TRIPS is the protection which is provided by WTO on the inventions of all the company technologies and which creates the minimum conditions of the patent protection. TRIPS facilitates the existence of software and e-commerce patents because it asks countries to give such a non-discriminatory protection although it does not particularly discuss digital advances.

5.1.2 WIPO and the Patent Cooperation Treaty (PCT)[19]*:* The PCT allows making one single patent application across various jurisdictions simultaneously and WIPO strengthens global

[16] U.S. Patent No. 6,064,981 (filed Mar. 1, 1999) (issued May 16, 2000).
[17] Lawrence Page et al., The PageRank Citation Ranking: Bringing Order to the Web, Stanford InfoLab Working Paper (1998)
[18] Agreement on Trade-Related Aspects of Intellectual Property Rights, 1995.
[19] Patent Cooperation Treaty, June 19, 1970.

cooperation. International e-commerce companies still have to be enforced through national regulations though it is advantageous.

5.5.3 Regional Instruments: The European Patent Convention[20] is applicable to patents in Europe, whereas in the ASEAN and African regions, regional frameworks are trying to harmonize the process, but to a varying degree.

5.2 Comparative Study of Jurisdictions

United States

The United States has been ahead in the case of software and business method patents. It is due to early leniency in decision making like State Street Bank[21] that e-commerce patents rose. CLS Bank[22] prevented this tendency by preventing abstract ideas. One-Click patent[23] used in Amazon remains a reminder of an American patent policy in e-commerce. The America Invents Act (2011) which streamlined post-grant review processes and one whose model shifted to a first-to-file one further changed the patent law.

European Union

The European patent convention does not patent software as such, but an invention of a technical nature may be patented. The Court of Justice of the EU (CJEU) has supported a limited approach whereby emphasis is laid on technical contributions at the expense of abstract algorithms. Such technologies as digital security and encryption, by example, may be patented, yet business processes are never.

India

Under Section 3(k) of Patents Act, India has a conservative position and computer programs[24] as such are not patents. Nevertheless, the Indian patent regulations (2017) permit inventions on software as long as they exhibit technical usage other than algorithms. Cases such as Ferid

[20] European Patent Convention,1973.
[21] State Street Bank & Tr. Co. v. Signature Fin. Grp., Inc., 149 F.3d 1368 (Fed. Cir. 1998).
[22] Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 573 U.S. 208 (2014).
[23] U.S. Patent No. 5,960,411 (filed Sept. 12, 1997) (issued Sept. 28, 1999).
[24] The Patents Act, No. 39 of 1970, § 3(k), India Code (1970).

Allani v. Union of India (2019)[25] marked the willingness of the judicial power to discuss computer-related inventions (CRI) as patentable in case they are technically contributed to.

China and Emerging Economies

Being more permissive has become the policy adopted by China that has accepted patents of business methods and software on the condition of demonstrating technologies solutions. The patents applications have soared tremendously due to the rapid rise of e-commerce giants such as Tencent and Alibaba. The most recent patent law reforms in China in 2021 as they indicated the ambition of China to become an intellectual property powerhouse that enforced patent laws on violations in its effort to thrive globally enhanced enforcement mechanisms, including punitive penalties in patent cases.

6. Difficulties in Protecting Digital Innovations through patents.

6.1. Statutory ambiguity on Software and Algorithms.

Patent laws in most parts of the globe are often not clear on the eligibility of software and other algorithm-driven findings. e.g., mathematical or business techniques or computer softwares per se not to be patented as per Section 3(k) in Indian Patents Act, 1970. The issue of uncertainty is found in deciding when a software-associated invention rises out of the realm of being a mere program, and is sufficiently innovative in the technical aspect, to be patentable. The Ferid Allani v. Union of India (2019)[26] case raised this point of concern. In this case, the Delhi High Court emphasized the fact that computer-related inventions could not be dismissed in general as long as they show some technical contribution. Likewise, the case of Alice Corp. v. CLS Bank International (2014)[27] of filling in patents through the abstract ideas without any direct prescribed legislation, enhanced insecurity in America. This grey area results in uneven usage where the innovators are confused on how wide the protection will be.

6.2. Challenges in cross-border e-commerce Enforcement.

Patents still get a territorial right despite the fact that e-commerce platforms are basically global. A patented algorithm that was made and patented in the United States may be used in a

[25] Ferid Allani v. Union of India, W.P.(C) 7/2014 (Del. HC Dec. 12, 2019).
[26] Ferid Allani v. Union of India, W.P.(C) 7/2014 (Del. HC Dec. 12, 2019).
[27] Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 573 U.S. 208 (2014).

jurisdiction that does not protect it. This causes enforcement loopholes, especially where the global consumer is affected by the infringement activities which are made in other server in foreign countries. As per the traditional concept of territorial jurisdiction, patents cannot have extraterritorial application except as enacted, such as in the case of Microsoft Corp. v. AT&T Corp. (2007)[28], in the United States. Therefore, the enforcement across borders will be challenging and it would require costly litigation in multiple jurisdictions and more forum shopping.

6.3. Absence of Technical Expertise in the Courts and Patent offices.

Patent challenges that are digitally innovative may entail a very technical understanding of encryption procedures, AI systems and algorithms. But, when there is a small experience, there would be conflicting decisions in its patent offices and courts. Training of patent examiners in India to review computer related inventions is still lacking which has caused a high rate of rejections and appeals. However, even though the European Patent Office (EPO) has technical boards, there are often contradictory outcomes concerning the assessment of the technical effect of software patents. Without the specialist judicial or administrative capability, even the nuanced differences between patentable innovation and an abstract idea are elusive.

6.4. Unnoticed violations: Piracy, imitation, and digital copies.

Unlike the physical world, digital innovations can be copied through reverse engineering, server side, or copying of the source code. As an example, the imitations of the Amazon or Netflix recommendation systems are sometimes hard to look at since they do not manifest themselves. Hidden violations test market inspections and other traditional approaches to enforcement. Moreover, the dark web portals often stimulate the theft of e-commerce technologies, such as an online payment system, which complicates monitoring and obtaining evidence.

6.5. Copyright, Trade Secrets, and Patents: Overlapping Regimes.

Protection of digital innovation often cuts across various legal systems. Whereas functional features such as algorithms can be pursued on patent and trade secrets on confidential information, source code could be placed under copyright. This overlap may introduce some

[28] Microsoft Corp. v. AT&T Corp. 550 U.S. 437 (2007).

form of uncertainty. As an illustration, the Defend Trade Secrets Act (2016)[29] is a business protection legislation commonly deployed by the United States to influence holders of patents in cases where cross-jurisdictional coverage is not possible.However, trade secret protection presupposes secretness, which contradicts the secrecy requirement with regard to patents. This uncertainty and lack of effectiveness of protection is one when inconsistency is applied in the overlapping structures.

6.6. Competition Law Concerns: Abuse of Patent Rights and Monopolization

Patents in e-commerce can raise concerns with regard to competition, either because they are excessively broad or excessively aggressive enforced. Even though it was legal, the One-Click patent of Amazon was not without its critics who considered it as unfairly competitive advantage. On the one hand, entry barriers can be a product of patent thickets, which are registered on the basis of incremental improvements and include multiple overlapping patents. Acquisitions of software and e-commerce patents of such internet giants like Tencent and Alibaba are a rising trend in China, raising issues of monopolization. Competition authorities are paying more attention to the question of whether patents are being used to hamper or facilitate access to the market or facilitate innovation. This rivalry highlights the significance of the need to balance the fair competition legislations with patent rights.

7. Reforumulation of law and Technological Reform to enforce Patent.

7.1 Legal Reforms: Requirement of Statutory Generality and Sector-Specific Regulations.

In order to minimize the occurrence of uncertainty in the digital protection of patents, laws need to be definite. The reforms may consist of introducing sector-related regulations on e-commerce developments, the inclusion of the technical effect descriptions, and the formulation of the criteria regarding the patentability of algorithms and artificial intelligence items in the field of ideas. Despite the fact that these are positive developments, there still is no universality in the 2017 guidelines[30] by India regarding computer related inventions. It may be more

[29] Defend Trade Secrets Act (2016)
[30] Office of the Controller General of Patents, Designs and Trade Marks, Guidelines for Examination of Computer Related Inventions (CRIs) (June 30, 2017)

predictable and judicial interpretation may be reduced with similar reforms in the US or the EU.

7.2 Specialized Patent Courts and Digital IPR Cells

Since the process of digital breakthrough is complex, digital IPR cells or expert patent courts have a chance to enhance enforcement greatly. Even though it has been faced with its troubles since Alice, U.S. Court of Appeals Federal Circuit (CAFC) can be used to exemplify a specialized adjudication paradigm. Technical shortages in India in terms of capacity can be filled through plans of specialized IPR benches and training courses on patent examiners. It can also be done proactively by monitoring patent claims on sites, which can be easily done by establishing digital IPR cells within the e-commerce authorities.

7.3 Technological Enforcement: AI-Based Detection and Blockchain Tracking

Technological solutions should be accompanied by the changes in the law. The AI-driven resources will be able to identify the similarities of codes, the illegal use of algorithms, and cross-platform software capabilities[31]. Another solution, which can be provided by blockchain technology, is the creation of records on the ownership of patents and license agreements that cannot be changed thus providing the opportunity to trace the stream of using innovations. IBM in particular has explored IP management solutions that use blockchain technology in a bid to achieve a digital provenance and prevent duplication[32]. These are methods that offer real time tracking of infractions committed in the digital commerce and can be used alongside traditional enforcement mechanisms.

7.4. Role of Intermediary Liability in Regulating Patents

On e-commerce platforms, such as Amazon, Flipkart, and Alibaba, third-party sellers often infringe on patents knowingly or not. The existing laws regimes have various amounts of intermediary liability. Though it does not have any noticeable parallels to the patent, the U.S. DMCA firmly underlines the so-called notice-and-takedown of copyright. Despite the requirement of platform taking action over effective notification of infringement under the

[31] Matthew Sag, The New Legal Landscape for Text Mining and Machine Learning, 66 J. COPYRIGHT SOC'Y U.S.A. 291, 322-28 (2019)
[32] Jörg H. W. M. T. B., Blockchain and Intellectual Property: A Primer, WIPO MAG., Dec. 2018, at 14, 16-17

China E-commerce Law (2019)[33], there is still no enforcement of patent-specific laws.To a large extent, the enforcement could be enhanced by transforming into intermediary responsibility to involve active monitoring, joint audits with patent offices, and stricter penalties to the non-compliance.

8. International Harmonization of Patent Frameworks

8.1 Divergence Between Jurisdictions

The differences in national patent systems render it difficult to make innovators all over the globe aware of what to do. The U.S. permits business method patents, software patents (with limited restrictions imposed by the case of Alice[34]), whereas the EU demands a technical contribution, and India has certain legal exceptions based on Section 3(k)[35]. China, on the other hand, is more permissive, welcoming novel concepts to e-commerce and reinforcing regulation. Such disparities impede the ability of the e-commerce companies to receive the identical protection.

8.2 Need for Global Patent Standards in Digital Commerce

E-commerce needs to go in line with universal norms due to the fact that it cuts across national boundaries. TRIPS sets very few requirements, yet its rules fail to tackle new emerging issues like blockchain technologies, artificial intelligence tools, and algorithms. The system of protecting patents might be on the decline even without the more active collaboration of states as it will damage the motivations to innovation and the capacity to enforce the law.

8.3 TRIPS+ Provisions and Regional Agreements

TRIPS + means that they find their way to regional trade arrangements that are going beyond the WTO minimum. Better IP protections include the Regional Comprehensive Economic Partnership (RCEP)[36] and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)[37] still implemented inequitably. These arrangements would establish

[33] Ya Wang & Yanmei Yang, Intellectual Property Protection in E-commerce, 8 Int'l Core J. Eng. 152 (2022)
[34] Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 573 U.S. 208 (2014).
[35] The Patents Act, No. 39 of 1970, § 3(k), India Code (1970).
[36] Regional Comprehensive Economic Partnership Agreement, Nov. 15, 2020
[37] Comprehensive and Progressive Agreement for Trans-Pacific Partnership, Mar. 8, 2018

minimum principles of electronic patent protection within the e-business particularly in the intermedia responsibilities and international implementation.

8.4. Proposals for Harmonization: WIPO Initiatives and Digital Patent Treaties

WIPO can be instrumental in creating a Digital Patent Treaty to bring software[38], artificial intelligence, and inventions connected with the e-commerce domain into putty. International dispute resolution can happen through programs such as the WIPO Arbitration and Mediation Center[39], however, more interdictive harmonization programs should be more lawful. The use of cooperation between patent offices, including the Patent Prosecution Highway (PPH), could reduce the discrepancy between particular outcomes and accelerate harmonized examination.

8.5. The Hegemony of Innovation and Competition in International E-Commerce.

Moreover, harmonization should guarantee competitiveness. Whereas, weak regimes slow down innovation, there are consequences of over-protection of patents that could lead to monopolization. A balanced framework would provide strong protection against real innovations, wasting protective measures against claims which are too general. This balance is the key to preserving the customer confidence, healthy competition, and long-term economic development in digital trade[40].

9. Results

The study concludes that, even though patents remain an important tool in protecting innovation, structural and legal limitations of the digital economy render them invalid. The juridical review of case cases and the law indicates that discussion of software, algorithm, and AI-powered systems remains unclear on whether they are patentable or not. In the United States (Alice Corp. v. CLS Bank[41]), Europe, Canada, and India (Ferid Allani[42]) court systems have tried to find limits. However, by relying on the opinion of judges alone, one may get mixed outcomes. The territorial nature of patents is another factor that creates gaps in the enforcement

[38] Mark A. Lemley & Casey B. Sullivan, The Human-AI Patent Gap, 75 STAN. L. REV. 1321, 1368-71 (2023)
[39] World Intellectual Property Organization, WIPO Arbitration, Mediation and Expedited Arbitration Rules for Film and Media, r. 1 (2023)
[40] ORG. FOR ECON. CO-OPERATION & DEV. [OECD], PATENTS AND INNOVATION: TRENDS AND POLICY CHALLENGES 9-12, 61-65 (2004)
[41] Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 573 U.S. 208 (2014).
[42] Ferid Allani v. Union of India, W.P.(C) 7/2014 (Del. HC Dec. 12, 2019).

of cross-border[43] e-commerce since the violations are hidden and it is easy to repeat and problematic to detect because of the digital nature of violations[44]. Whereas trade secrets and copyright present an even greater complication to the defensive environment, competition law considerations raise awareness of the perils of overdevelopment of monopolies caused by the excess of digital patents.

10. Discussions

Digital innovations need improvement on patent protection through legislative and institutional change.The clearer eligibility of patents can be achieved through the formulation of legislators and some criteria regarding the "technical effect" and the ability to differentiate digital innovations that can be patented and the business process or abstraction[45]. Specific standards of fintech, AI-enabled and e-commerce would reduce the interpretive ambiguity. Technical soundness and adjudicatory consistency may also be enhanced by establishing special patent benches or online IPR cells of competent examiners[46]. Policy reform should also address the areas of enforcement gaps. Intermediary liability regimes that were specific to patents would make e-commerce platforms responsible together as to the monitoring and addressing of infringements.

Technological solutions, such as blockchain-based IP tracking and AI-sensitive detection protocols, could also be included in the formal enforcement policy to enhance real-time observation of the digital piracy and replication[47]. It is characteristic of the nature of e-commerce that it is decentralized in nature, and this issue is impossible to resolve solely through one-sided reforms.International harmonization must still be urgently required. Though TRIPS provides a point of departure, the technologically neutral provisions of the modern digital patents cannot enjoy the benefits of the same.To ensure harmonization of software, algorithms, and AI innovations, WIPO needs to strive to be the negotiator on a Digital Patent Treaty[48]. The extension of programs such as the Patent Prosecution Highway (PPH) and the

[43] Dan L. Burk & Mark A. Lemley, The Patent Crisis and How the Courts Can Solve It 154-60 (2009)
[44] Shyamkrishna Balganesh & Sarang Vijaykumar, Coding for Categorization: A New Framework for Understanding Patent Eligibility Doctrine, 107 Iowa L. Rev. 1879, 1895-1903 (2022)
[45] European Patent Office, Guidelines for Examination, pt. G-II, 3.3.1 (Mar. 2024)
[46] Rochelle Cooper Dreyfuss, The Federal Circuit: A Case Study in Specialized Courts, 64 N.Y.U. L. Rev. 1, 3-8, 28-32 (1989)
[47] World Intellectual Property Organization [WIPO], WIPO Technology Trends 2021: Assistive Technologies 85-93, 108-115 (2021)
[48] Peter K. Yu, The Algorithmic Divide and Equality in the Age of Artificial Intelligence, 72 Fla. L. Rev. 331, 384-91 (2020)

cross-border mediation services of WIPO should be considered to reduce the time and effort spent on shopping in forums and to increase the speed at which the rights are recognized[49].

Moreover, it would be easy to add TRIPS+ norms that focus on cross-border electronic trading to regional agreements like CPTPP and RCEP. The future of patent protection in e-commerce will be determined by the equilibrium between the promotion of innovation and reasonable competition. The current competitive law protection and control of claims should be tightened and enhanced due to the development of digital technologies since the threat of control due to broadly developed patents increases significantly. The technology of blockchain and artificial intelligence will also make the detection of real-time and monitoring of IP globally possible and will change the enforcement. With time, the digital protection of patents should be not isolated at a national level, but systematically, using technology. This will ensure that inventors enjoy just compensation in the fast growing global digital economy and protect the interests of consumers and market equities[50].

11. Conclusion

The digital economy has revolutionized global trade making e-commerce platforms instrumental in innovation, trade, and interaction with customers. This shift has however uncovered some fundamental deficiencies within the patent regimes which remain ill-equipped to protect digital innovation such as payment methods, algorithms, artificial intelligence tools and authentication systems[51]. The ambiguity of the statutes, the inability to enforce patentability in a cross-border context, and the jurisdictional disparity are the challenges that make traditional notions of patentability seem to struggle with intangible inventions, as well as the lack of clarity on a matter in the law, making investors uncertain and unconfident. India does not allow business procedures or programs in general, but is opening up its judicial process, EU only protects inventions that could be observed in terms of technical effects, the U.S. has had inconsistent judicial rulings on software patenting and China has a more pragmatic, policy-oriented position. This inconsistency of IP regimes, overlapping IP regimes and monopolization raises doubts among digital inventors who face a substitution.

[49] Five IP Offices, Patent Prosecution Highway (PPH) User Guide, at 2-4 (May 2024)
[50] U.S. Dep't of Justice & Fed. Trade Comm'n, Antitrust Enforcement and Intellectual Property Rights: Promoting Innovation and Competition iv-v, 7-13 (2007)
[51] U.N. CONF. ON TRADE & DEV. [UNCTAD], DIGITAL ECONOMY REPORT 2021: CROSS-BORDER DATA FLOWS AND DEVELOPMENT: FOR WHOM THE DATA FLOW, at ix-xi, U.N. Sales No. E.21.II.D.18 (2021)

Nevertheless, patents still remain crucial in the innovation of e-commerce. They promote licensing and commercialization policies, exclusivity to necessary technologies such as blockchain transactions, AI-based recommendations, and encryption measures, and support research and innovations[52]. Without such mechanisms, digital innovations are susceptible to unfair competition, piracy and copying.

Going forward there should be protection of patent of technologies. Some of the notable changes are; the sector-related regulations, special patent courts that are both technical savvy and legal clarity regarding what is patentable. The use of technological tools such as blockchain, IP tracking, and AI-oriented copyright detection can assist in supporting legal proceedings, hence harmonizing standards, speeding up the recognition process, and developing cooperation. The global scale requires the crucial elements of enforcement, WIPO harmonization or a new digital patent treaty[53]. Patents continue to play a critical role in intellectual property and an enormous engine of a business over the internet. Enforcement and powerful legislation can assist in using patent systems to foster growth and healthy competition in the global digital economy where all can contribute to inclusivity and innovation[54].

The broad social implication of the inability of the current patent systems to protect digital inventions in e-commerce is brought to the fore in this research. The absence of a clear and firm protection is slowing down the pace of the innovation, and it makes the innovators vulnerable to the problem of piracy, unfair competition, and the lower incentive to invest in the new technologies[55]. This does not only discourage entrepreneurship, but also undermines consumer confidence towards the internet platforms as consumers rely on the safety, authenticity as well as integrity of online digital systems to make their day-to-day purchases. Better and stable patent protection would foster the spirit of innovation as people would come up with solutions that can make digital commerce more accessible, secure, and efficient. More responsible online places, better experience with the customers, and increased trust in online platforms would contribute to flourishing communities. In addition, global standards will be

[52] Pamela Samuelson, Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions, 39 EMORY L.J. 1025, 1027-35 (1990)
[53] Rochelle Cooper Dreyfuss, An Alert to the Intellectual Property Bar, 37 BERKELEY TECH. L.J. 897, 920-28 (2022)
[54] ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT 19-33 (2004)
[55] ORG. FOR ECON. CO-OPERATION & DEV. [OECD], OECD DIGITAL ECONOMY OUTLOOK 2020, at 187-94 (2020)

more specific, which will stimulate pure competition, prevent the abuse of monopoly, and ensure that technological changes are more evenly distributed. When patent regulations are reformed to the digital era one day, it will not only benefit the society by ensuring that innovation is safeguarded but the economy is boosted and long term sustainability is achieved in the global digital economy, consumer confidence, development etc.